Patent Application of

Jon Cameron

and

Tobin Gaedke

for

THERMOCHROMIC BAR CODE

Background -- Field of the Invention

This invention relates to bar codes, specifically to identifying the bar code's temperature range.

Background -- Discussion of Prior Art

Universal Product Code and Bar Code

The Universal Product Code (UPC) bar code was originally introduced in 1971, Uniform Code Council Internet publication at www.uc-council.org/ucchp.htm, to provide an efficient method of matching a product against a pricing file and recording a sale. When the

bar codes were scanned at cash registers, the resultant transaction data was stored electronically. By using this transaction data, businesses could track their products' sales and then market them accordingly. Prior bar code designs also include the European Article Number (EAN) and Japanese Article Number (JAN).

These bar codes all fail to resolve the need for tracking environmental conditions such as location and temperature. When the UPC was introduced in 1971, its scope was to communicate basic information from a main product file to an on-line transaction file. Storing the resultant transactional detail produced unmanageable file sizes. Computer systems of this generation were unable to store and process large transactional databases. These computer systems were unable to manage historical databases with only several fields data, making larger information gathering needs impracticable. Therefore, current applications of the UPC bar code data are limited by its original intention of only limited information retrieval.

Today, data from bar codes are now used by store-planning software to plot packaged goods products within a store. However, store-planning software was not invented until 1979. As space planners became sophisticated in their skill, it became apparent that UPC transaction data could identify product, price, and promotion but not absolute position. Product, price, promotion and position are called the Four P's of Marketing and traditionally comprise the basic information about a product.

Certain items, such as soda, bottled water, juice, beer, and margarine can have two separate, simultaneous locations within a retail store. For example, beer can be located within a storage cooler and an adjacent floor display. To correctly plan supply, orders, and marketing, it is necessary to know from which of the two locations a particular product was sold. At present, marketers have to guess at pertinent questions:

How much did I sell from my normal selling space?

How much did I sell from the display?

How did this display effect the product's promotion?

Thermochromic Materials

Thermochromic materials are substances which emit different colors at associated temperature ranges. Thermochromics have been used as active components in temperature-specification devices, as shown in U.S patent 4,156,365 to Heinmets et al (1979), U.S. patent 5,144,112 to Wyatt et al. (1992), and U.S. patent 5,622,137 to Lupton, Jr. et al. (1997). Each of these patents requires a human operator to visually identify the material's color and estimate its temperature accordingly. These inventions do not account for the different color-perception capabilities, or lack of color perception, among the general population.

Some thermochromic materials exhibit a one-time, permanent (quondam) change in color, as the one demonstrated in U.S. patent 5,622,137 to Lupton, Jr. et al. (1997), while other thermochromics are reversible, as shown in U.S. patent 5,558,700 to Shibahashi et al. (1996), and U.S. patent 5,480,482 to Novinson (1996).

Objects and Advantages

Accordingly, the object of this invention is to provide an accurate method of establishing the temperature range of a product to which a bar code is attached. Several other objects and advantages of the present invention are:

(a) to provide a bar code that requires no hardware modifications of bar code readers;

(b) to provide a bar code that can establish a historical temperature range that marks product as unsalable;

(c) to provide a bar code that can be printed using current package printing technologies;

(d) to provide a bar code that will not significantly increase the price of the packaging;

(e) to provide a bar code that identifies the position from where the product was selected when the product has multiple locations;

(f) to provide a bar code that can contain two different codes;

(g) to provide a bar code that allows the temperature differences among a set, sample, or population of items to be efficiently identified.

NP

BRIEF DESCRIPTION OF THE DRAWINGS.

~~**Drawing Figures**~~

Fig 1 shows an example of a UPC bar code.

Fig 2-A shows a thermochromic UPC bar code at standard room temperature.

Fig 2-B shows the same UPC bar code from Fig 2 when stored below 65 degrees F.

Fig 3 shows an exploded view of the bar code from Fig 1.

Fig 4-A shows an exploded view of the bar code from Fig 2.

Fig 4-B shows an exploded view of the bar code from Fig 3.

Fig 5 shows an example of a null UPC bar code.

List of Reference Numerals

10	Bar code
20	Module
30	Digit
40	Check Digit
50	Numeric Character
60	UPC Version A Bar code
70	Numeric Character Set
80	Thermochromic Digit
90	Light Module
100	Dark Module
110	Thermochromic Module
120	Null Bar code
130	Thermochromic Bar code

Summary

The purpose of this invention is to provide a method of determining an item's temperature range when its bar code is scanned. This is accomplished by printing its bar code with thermochromic material(s) such that two separate codes are stored on the same bar code and such that each code is exclusively visible within a specific temperature range.

Description–Figs 1 to 5

An example bar code **10** shown in Fig 1 is a UPC Version A bar code **60**. Within bar code **10** is a series of parallel dark lines and light spaces of varying thickness which represent a numeric combination. Below bar code **10** is a numeric character set **70** which translates bar code **10**. A digit **30** is a unit of barcode **10** consisting of two dark bars and two light spaces. Fig 1 illustrates bar code **10** with twelve digits **30**. A module **20** is the smallest defined space in bar code **10**. There are seven modules **20** per digit **30**. Each digit **30** of bar code **10** is represented by a numeric character **50** located directly below digit **30**. A check digit **40** is used to verify barcode 10.

Each digit **30** is represented by seven modules **20**. A light module **90** and a dark module **100** are shown in Fig 3. Each unique digit **30** is constructed of a set of light modules **90** (Fig 3) and dark modules **100**. The arrangement of modules **20** (Fig 1) creates the visual appearance of a series of dark lines and light spaces within bar code **10**.

A typical embodiment of the present invention is illustrated in Figs 2-A and 2-B. A thermochromic bar code **130** (Figs 2-A and 2-B) incorporates thermochromic materials into modules **20** of one of its digits **30** and its check digit **40**. Thermochromic materials, including inks, are materials which display different colors at different temperature ranges. For example, a single ink made of thermochromic materials can be black at one temperature range and transparent at another temperature range. A thermochromic module **110** (Fig 4-A and 4-B) is printed with thermochromic materials. A thermochromic digit **80** (Figs 2-A and 2-B) is

comprised of thermochromic modules **110** (Fig 4-A and 4-B) instead of standard ink modules **20** (Fig 1). An example of a null barcode **120** is shown in Fig 5. Null barcode **120** (Fig 5) incorporates thermochromic materials into all of its digits **30**.

From the description above, a number of advantages of the thermochromic bar code become evident:

- The thermochromic bar code provides the ability to print two bar codes within the space of a single bar code. A secondary bar code can replace a base bar code when the desired temperature range in achieved.
- The thermochromic bar code can be printed using normal ~~packaging printing~~ package-printing technology without significantly increasing printing costs.
- The thermochromic bar code requires no hardware modifications of bar code readers.
- The thermochromic bar code allows several new functional uses of a bar code. For example, it can be establish and maintain a previous temperature range which then can be used to record a environmental event in the bar code's history. This functionality ~~can~~ used practically to determine if a product, such as meat, has reach a dangerous temperature range. It can also can be used to establish temperature differences in a group of items. The most apparent commercial use is its attachment to a retail product that has both hot and cold locations within a store. This will allow businesses in the supply chain to identify from which location the product was actually sold.

Operation–Figs 1 to 5

Thermochromic bar code **130** (Figs 2-A and 2-B) can be printed using current standard printing technology. It can be scanned by any bar code reader (not shown). A bar code reader is a device which can optically scan bar code **10** (Fig 1) and translate its code into electrical signals.

The purpose of this invention is to incorporate two separate bar codes **10** (Fig 1) within the space of one bar code **10** (Fig 1) such that each code is exclusively visible at a specific temperature range. One possible method of printing thermochromic bar code **130**, as shown in Figs 2-A and 2-B, is to first print bar code **10** (Fig 1) in standard ink, then print overlapping module(s) **20** (Fig 1) with thermochromic material. The thermochromic materials used are only visible at a certain temperature range. When the temperature of thermochromic bar code **130** is not within this range, it appears as Fig 2-A. When the temperature of thermochromic bar code **130** is within this range, thermochromic modules **110** (Figs 4-A and 4-B) will become visible and display thermochromic bar code **130** as seen in Fig 2-B. This method allows for two or more separate bar codes **10** to be printed in the same area of a single bar code **10**.

Depending on the type of thermochromic materials used, the thermochromic bar code could have different uses:

- To identify product position within a store, the thermochromic materials used will be able to convert repeatedly from visible to invisible, as shown in Figs 2-A and 2-B, depending on the product's current temperature.
- To identify a product's temperature history or to determine whether a product has been exposed to undesirable thermal conditions, the bar code would be created with thermochromic materials that transform permanently into a null bar code. The null bar code shown in Fig 5 is one in which no distinction between dark modules and light

modules can be made by scanning equipment. An example of said null bar code would be an area of solid black or solid white.

Sources of Supply

The following companies are suppliers of thermochromic materials and dyes:

CHROMATIC TECHNOLOGIES INCORPORATED, Ithaca, New York

SPEAR U.S.A., Mason, Ohio

FLINT INK CORPORATION, Dallas, Texas

MCK CONSULTING INC., Mississauga, Ontario

Conclusion, Ramifications and Scope of Invention

The thermochromic bar code described here will provide suppliers and retailers a reliable method of determining whether a product sold came from a refrigerator or a shelf. This is accomplished by using the thermochromic properties of an ink to imbed a second bar code within a primary bar code. This relatively inexpensive process of identifying product will require minimum hardware and software modification of enterprises in the supply chain.

Although the description above contains many reference to the UPC bar code, this invention is not limited to the UPC. It can be used for EAN, JAN, and any other bar code for which the use of this process is desired. This thermochromic bar code could also be useful as an efficient method of identifying temperature differences among a set, sample, or population of items.

Similarly, an entire thermochromic bar code could be attached to a product that must be maintained below a certain temperature range. If the temperature exceeds the desirable range, the bar code would disappear, either partially or wholly. For example, assume milk must be kept below 52 degrees Fahrenheit. Exposure above that temperature range causes the quality of the product to degrade. If the carton exceeds the safety temperature, the UPC code would permanently vanish making the product unsalable.

Accordingly, the scope of this invention should be determined not by the embodiment illustrated, but by the appended claims and their legal equivalent.